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Brief 69-10037

NASA TECH BRIEF

Use of Both Linear and Logarithmic Transfer Functions To Increase Dynamic Range of Visual Channel

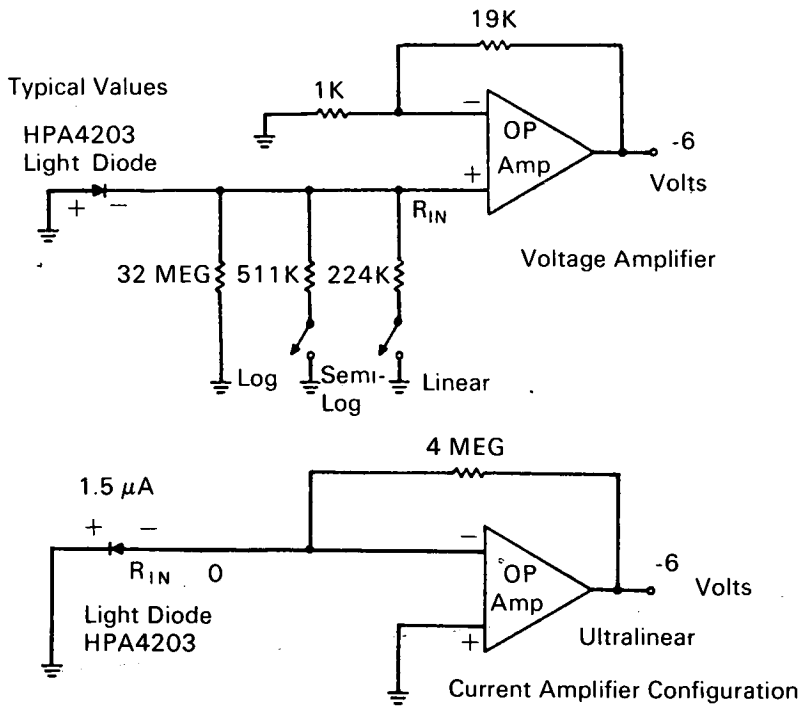

FIGURE 1

The problem:

The visual channel of the dual channel radiometer has a useful range of better than 1 to 10,000 foot-lamberts (or 80 db). This is 50 db greater than the approximately 30 db dynamic range limitation of existing data storage and transmission links.

The solution:

The use of both linear and logarithmic transfer functions in the visual channel allows the coverage of 1 to 10,000 foot-lambert scenes.

How it's done:

The visual detector of the radiometer is a commercially available ultrafast, low-noise silicon planar PIN photovoltaic diode with high detectivity for visible and near infrared (0.4 to 1.0 microns) radiation. Use of the photodiode in a resistively-loaded, unbiased mode permits selection of a broad range of transfer characteristics from pure logarithmic for open circuit voltage amplifier case to pure linear for the short-circuit current amplifier case. Use of a common voltage amplifier and selectable load resistors

(continued overleaf)

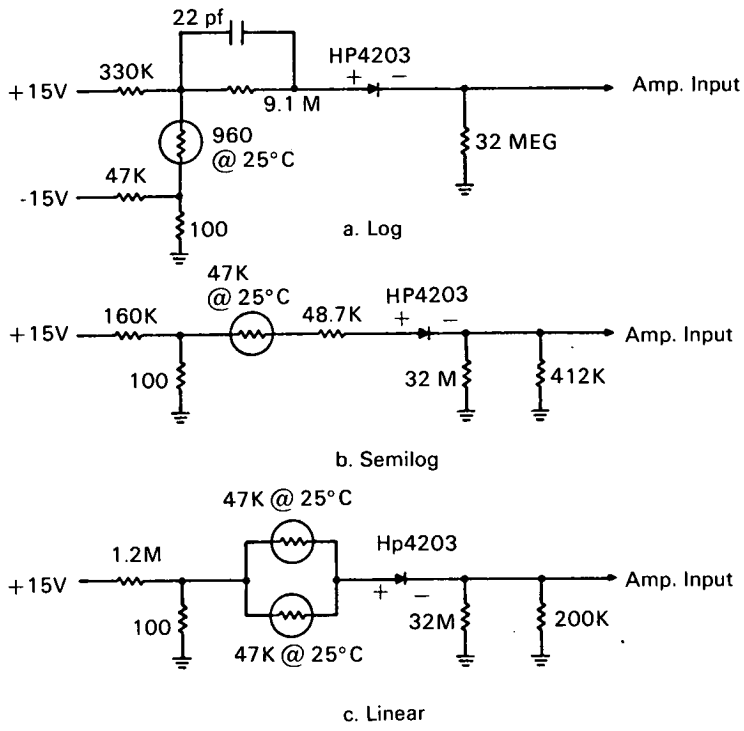

FIGURE 2

permits operation in the log mode using a 32 megohm load, semilog mode using 511 kilohms, and linear mode with 224 kilohms. A departure from linearity of a few decibels in the linear mode is a result of maintaining the load resistance high enough to avoid reduction short-circuit current requirement. The light diode resistance loading and amplifier configuration is shown in Figure 1.

Selection of the log, semilog, or linear, transfer characteristic is accomplished with 2N4391 junction FET switches which connect the proper output load and matching input conditioning network to the light diode. Each mode is initiated through a separate command line activated by standard 0-volt enable and +5-volt disable logic levels.

The LOG output load of 32 megohms is permanently connected and serves to tie down the amplifier input (in preference to leaving it floating). Upon LOG command, the LOG conditioning network is switched on completing the light diode circuit.

The semilog and linear networks and loads are disconnected. In either of the latter two modes, the 32 megohms shunts the selected output load resistor, changing the net load by approximately 1 percent.

Conditioning networks, shown in Figure 2, in conjunction with output load resistors permit the precise adjustment of: compression characteristics, by total loop resistance loading of the light diode; full-scale output level, by adjusting the resistance divider ratio or amount of resistance in the output compared to the input network resistance; temperature compensation, by using thermally sensitive resistors in the input network; and, zero scale output level adjustment using bias subtraction.

Note:

Documentation for the invention is available from:
Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10037

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

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